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[Raku-Yu]

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Kyoto University Newsletter

AUTUMN 2014
Issue

26



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from
Kyoto-U

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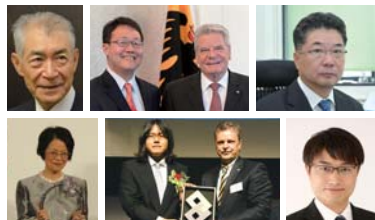


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A Note on Order of Names

As a general rule, names
appearing in *Raku-Yu* are
written in given name/family
name order.



This name was taken from the
assembly hall called "*Raku-Yu
Kaikan*" that commemorated
the 25th anniversary of the
founding of Kyoto University.

Editor's Notes

The work highlighted in this issue, implicitly shows flux: people are easily affected by environmental change, like trends, time lags and others. Assoc. Prof. Fujihara describes how cookbooks reflect social trends and lead social changes, as well as reveal the anxieties and aspirations of people living during those times. Prof. Okamura generated mutant mice which can rapidly recover from jet lag, so that one day jet lag and shift work may become therapeutic targets. As you can see, *Raku-Yu* has been redesigned with a more reader-friendly format. We hope this new format will serve readers well. From this issue, we have added two new sections. One is World-renowned KU Alumni. Prof. Heui-Soo Kim from Busan, South Korea is the first alumnus featured. Another is Prize, Award and Honor Winners with comments from recent winners. During the calibration process, Prof. Mori won the Albert Lasker Basic Medical Research Award. More details will be in the next issue - don't miss it.

Cover: "Sumiyoshi Myojin" from "Sanju-roku Kasen Zo" (Portraits of Thirty-six Poetry Immortals) in the collection of the Kyoto University Library

The cover of this issue features a landscape drawing of Sumiyoshi Myojin Shrine (also known as Sumiyoshi Grand Shrine, located in Osaka). The shrine is dedicated to a deity of poetry because of which has a legend that some ancient emperors were given oracles from Sumiyoshi Myojin with poems. Moreover, many famous poets visited the shrine with beautiful scenery and composed poems.

The image of the shrine was included at the beginning of a volume of *Sanju-roku Kasen e-maki* (a two-volume set of picture scrolls representing the Thirty-six Poetry Immortals), as if it is the guardian deity of them. It is very rare and precious that the image except poets was included. Up to early-modern times, the Thirty-six Poetry Immortals had been a popular motif portrayed in various formats, including picture albums and framed paintings. (Komachi Ono, one of the 36 poets, was introduced in *Raku-yu*'s 22nd issue.)

Attractive Features of Kyoto University Education

Under the tradition of academic freedom, Kyoto University has been pioneering diverse academic frontiers, producing many world-class researchers, including Nobel Prize laureates and Fields medalists. Hence the University has come to be known as Japan's leading research-oriented institute. We must not forget, however, the fact that the University's cornerstone lies in its undergraduate and graduate school education.

At Kyoto University, graduate school students are provided with opportunities to learn at the front line of knowledge creation. As members of various research teams, students also have opportunities to discuss with and be inspired by leading researchers from around the world. These experiences are of tremendous help to students in extending their own capacities. In the academic year 2009, Kyoto University commenced cross-disciplinary graduate school education, designed to promote interactions between students of diverse graduate schools and to expand their research interests, transcending the boundaries of their respective majors. Moreover, five-year programs leading to a PhD were jointly initiated by multiple graduate schools, research institutes and centers. Some of these programs, among others, have been selected as target projects to be financed by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). In this way, Kyoto University is promoting both educational and research activities in an integrated manner.

At the undergraduate level, the Institute for Liberal Arts and Sciences provides a broad range of knowledge, fostering students with international common sense. To enhance students' competency in foreign languages, the International Academic Research and Resource Center

for Language Education was established within the Institute. To build students' capacity in response to the growing needs of globalization, Kyoto University is dynamically enhancing its undergraduate education by fusing liberal arts and specialized education of respective faculties.

Kyoto University is committed to more innovative programs. To foster future global leaders Kyoto University launched the John Mung Program, in which students and staff are dispatched to overseas universities. In academic year 2013, the Shishu-Kan Graduate School of Advanced Integrated Studies in Human Survivability was founded with the aim of cultivating global leaders with lofty aspirations. In academic year 2014, the University filed applications for the MEXT Super Global Universities (SGU) program.

Kyoto University brings together many outstanding researchers from around the world. Taking advantage of this strength, we are resolved to cultivate human resources capable of pioneering new academic frontiers, conceiving innovative ideas and exerting outstanding leadership on the global stage. At the same time, aiming at the creation of diverse knowledge to pioneer the future, we will continue developing the high-performance research and educational environment in which to ensure a continual quest for truth.



Toshiyuki AWAJI
Executive Vice-President of Kyoto University



Toshiyuki AWAJI Executive Vice President
Toshiyuki Awaji embarked upon the study of marine science because he was fascinated by the borderless sea and its infinite potential.

Beginning with a study of the Seto Inland Sea, he gradually expanded the scope of his research. His interest in the Kuroshio Current led him to study the Pacific Ocean. Next, he surveyed the Indian Ocean as well. In addition to observing the surface layer, where major ocean currents flow, he makes an optimal diagnosis of seawater movements in the middle layer (depth of several hundred meters) and the deep sea (depth of 5,000 meters).

"Researchers must remain modest and open-minded toward reality," the Executive Vice President said. "I sometimes found suspicious points in what was believed to be self-evident truth. That was the moment when I began my scientific studies." Driven by his strong desire to discover the actual truth, he cast a critical eye upon widely accepted theories. This approach led to his invention of the data assimilation method, now widely used in weather forecasting by researchers worldwide.

Many of his students inherited his research approaches. Executive Vice President Awaji has been devoting his life to fostering next-generation researchers, based on his firm belief that it is the responsibility of Kyoto University to lead the global academic world and produce scientists capable of contributing to global society. As a result, his laboratory has produced many leading researchers in oceanic climatology, who are active at the front line of the science. Executive Vice President Awaji firmly believes that students must have firsthand experience of the world outside Japan, in order to become global leaders. He therefore encourages students to attend academic meetings overseas, sometimes even helping them by paying related expenses out of his own pocket. After assuming the Executive Vice Presidency, he began to devote himself to planning educational programs with equal enthusiasm. "My wife is my most rigorous critic," he says with a smile, "but she is also my best supporter."

The John Mung Program Supports Aspiring Global Players

The John Mung Program (Kyoto University's program to dispatch its young members overseas) was named after John Mung (1827–1898), a Japanese fisherman also known as John Manjiro, who, after being shipwrecked, was rescued by an American whaler ship. He subsequently studied in Massachusetts at the end of the Edo Period (1603–1868), when Japan was maintaining its national isolation policy. After Japan reopened its ports, John Mung served his native country as an interpreter and professor of English language. The John Mung Program, launched in 2012, supports students, junior faculty members and staff, respectively, with their studies, research activities and on-the-job training at overseas institutes. Following the model of John Mung, who pioneered his own path in a country totally unknown to him, participants in the Program are expected to explore global frontiers. Through this program, the University aims to foster next-generation players active on the global stage.

For this issue of *Raku-Yu*, our correspondent had the pleasure of interviewing a student and a junior faculty member who were dispatched overseas under this program. In addition, an article was contributed by a staff member who is currently working in the United States.

1. Program for Students

Under the John Mung Program, Kyoto University undergraduate and graduate students are dispatched to leading universities and institutes outside Japan. These students are expected to develop careers in their respective academic fields by engaging in research activities in the exceptional environment offered by the world's leading universities and institutes. At the same time, they are expected to gain international experience both on- and off-campus, including at college dormitories. In providing students with opportunities to study abroad, Kyoto University aims to foster next-generation global leaders with international mindsets and global perspectives.

Interview with Dai Yamawaki, 1st year in the Doctoral Program at the Graduate School of Economics

What made you apply to the Program?

I have been to various countries, but none are English-speaking countries. Although I am a good speaker of the Russian language, I thought that I would need English proficiency as well. I applied to the John Mung Program, since it sounded great to study at University of Oxford, which is known for its exceptional legacy. Through the Program I also hoped to meet students from other universities and those specializing in majors other than mine, since this would certainly inspire me and broaden my own perspectives.

In what way were you selected from among many applicants?

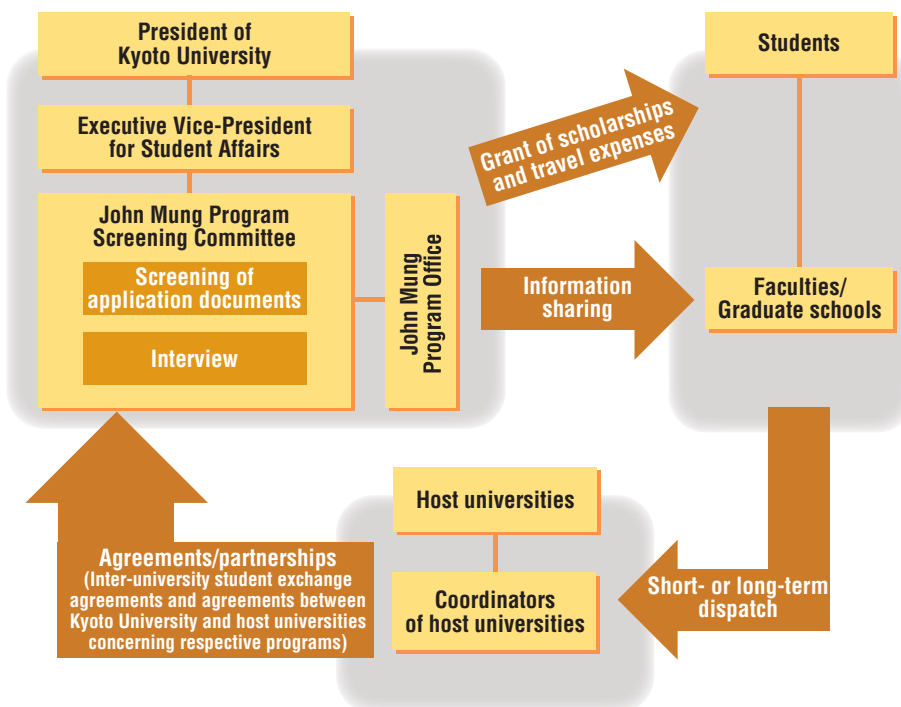
There were two stages for screening applicants: the screening of the application documents, and an interview. At the interview, after I explained my reasons for



applying, I was asked many questions by three professors. One of them asked me what Kyoto University and University of Oxford had in common. Since I was not prepared for such a question, it was difficult for me to answer.

What did you do at University of Oxford?

First, students of the John Mung Program



Flowchart of the Program for Students

were sorted into three classes in accordance with their level of English proficiency. In my class, in the morning we studied academic writing and held discussions in English on a given topic. In the afternoon, we attended graduate-school level lectures concerning contemporary European politics. In discussions, we called each other by our first names; even the professors were called by their first names. It was truly inspiring and stimulating to have deep discussions with students of University of Oxford in this friendly atmosphere.

What are some differences between students at University of Oxford and Kyoto University?

Well, I have the impression that the students' priorities are different. Oxford students place the utmost priority on academic work, whereas most students of Kyoto University believe that they should seek an optimal balance between academic work and other activities, such as club activities, side jobs, and volunteer activities etc.

Do you think you have changed since studying at Oxford?

I became less reluctant to speak up about my own views. When I find a disagreeable point in another speaker's remarks, I don't hesitate to point it out. Even now, the members who studied at University of Oxford hold weekly meetings to engage in discussions on various themes in English. In this way, we try to maintain our English proficiency. We also hope to retain our habit of discussing from diverse perspectives, since we all know that this is essential. It's truly stimulating and rewarding to hear other students' views, especially those specializing in other fields. I am pleased that I now have good friends with whom to hold open and in-depth discussions.

What is your impression of the United Kingdom?

Well, meals were much better than I had expected. I also enjoyed excursions organized by students of University of Oxford. On weekends, I went to London

to enjoy opera performances. I also visited the Sherlock Holmes Museum, since I am enthusiastic about the stories. I even had an opportunity to meet the president of the World Coal Association. This was very profitable since my research theme is related to the governance of natural resources. I enjoyed my time in England thoroughly. I wished I could have stayed longer.

What aspect of the John Mung Program was most attractive for you?

The Program allowed me to study at one of the most prominent universities in the world. The financial support was also great. Above all, the Program provided me with ample opportunities to meet many people and broaden my views.

2. Program for Faculty Members

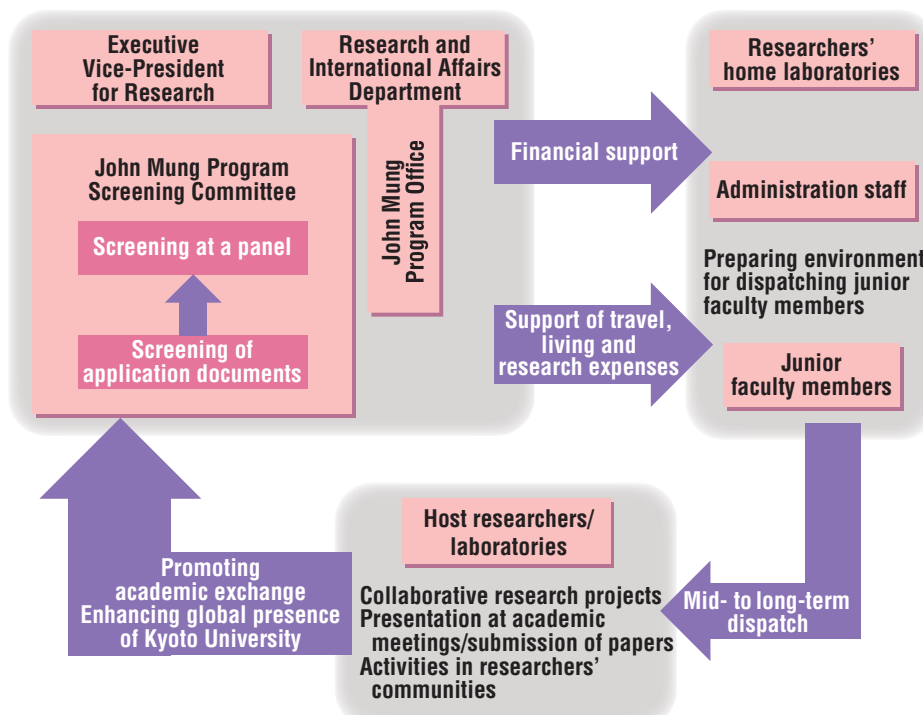
To dispatch faculty members overseas, the John Mung Program offers two types of grants: one for the researchers to be dispatched and the other for their home labo-

ratories during their absence. By supporting and promoting mid- and long-term research activities by junior faculty members on the global stage, Kyoto University intends to enhance its international competitiveness, and ultimately, its global presence.

Interview with Junko Murai, Project Assistant Professor, Graduate School of Medicine

First, please tell me what inspired you to apply to the Program.

Before applying to the John Mung Program, I studied at the U.S. National Institutes of Health (NIH) from March 2010 to September 2012. During my time there, I discovered the mechanism of a certain anticancer drug. My paper on this discovery was favorably evaluated and has been cited frequently to date. Although I began writing two additional papers on further studies of my discovery, I was unable to complete them during my time at NIH. I applied to the John Mung Program because I wanted to continue



Flowchart of Program for Faculty Members



my research activities at NIH and complete the half-finished papers. Thanks to the grants provided by the John Mung Program and the Kyoto University Foundation, I was able to continue my research activities at NIH for an additional six months, and to finish the two papers.

Please tell me about the screening process you experienced.

At the interview, I tried to convey my ardent wish to complete the half-finished papers. I knew well that the purpose of the John Mung Program was to enable Japanese researchers to have international experiences. In that light, I thought that other candidates were more eligible than I, since by that time I had already studied abroad for two years. Yet I tried my best to impress the interviewers.

Do you think you have changed since studying abroad?

Before studying abroad, I believed that my task at my lab was simply to follow the instructions of my boss. In the United States, however, I learned that I had to consider my own research themes and develop research plans through discussions with my boss. I now believe this is the right approach. My colleagues, however, might get the impression that I have become bossy.

Did you enjoy your stay in the United States?

Certainly. On weekdays, I engaged in research activities all day long. I was allowed to conduct any experiment I wanted to do. I was also allowed to prepare plans for purchasing necessary items. I truly enjoyed my time at NIH.

Finally, what point of the John Mung Program do you regard as most attractive?

When researchers leave their labs to study abroad, the labs must compensate for their absence in one way or another. The John Mung Program supports not only the researchers who are dispatched, but also their labs, since it provides grants to cover extra personnel and operational expenses incurred during the researchers' absence.

3. Program for Staff

Under the John Mung Program, young staff members of Kyoto University are also dispatched to overseas advanced educational institutes and international organizations. Through on-the-job training in practical business relating to international affairs, the dispatched staff members can improve their business ability and proficiency in foreign languages. At the same time, they are expected to build human networks that transcend national boundaries.

**Contribution from Sayaka Seike,
Personnel Division, General Affairs
Department**

My “Knight Errant” in the United States

Under the John Mung Program, I am currently receiving on-the-job training at the headquarters of the U.S. - Japan Research Institute (<http://www.us-jpri.org/>), a non-profit organization jointly operated by eight Japanese universities (Kyoto University, Doshisha University, Keio University, Kyushu University, Ritsumeikan University, The University of Tokyo, University of Tsukuba, and Waseda University). At this NPO in Washington, D.C., I am learning various methods of organizing

seminars and conducting office management jobs.

When I first heard about the John Mung Program, I was interested in learning new business approaches at an overseas organization. I thought it would be very thrilling to have such an experience. At the same time, I was concerned about my lack of English proficiency and the possible inconvenience that my sudden transfer might inflict on my boss and colleagues. However, they all encouraged me to take on the challenge.

In the United States, I find it difficult to negotiate with external agents. In one case, for instance, I engaged in a negotiation assuming that quality service—similar to that in Japan—would be offered, but found that I was too optimistic. In another case, because of my insufficient English proficiency, I was unable to negotiate on an equal footing. Although such experiences are stressful, I enjoy meeting many people during and outside of business.

It is truly stimulating and inspiring to meet many people here. Several American friends of mine, who are about my age, often tell me of their future career plans. Young Japanese students studying in the United States talk to me about their aspirations. On seminars and other occasions, I also have opportunities to hear views of policymakers and researchers from think tanks. I believe this experience will surely benefit me in developing my own career as a university staff member.



Send-off Party for Participants in the John Mung Program

March 11, 2014

Under the John Mung Program, Kyoto University dispatches researchers and students to leading academic institutions overseas. This year's send-off party was held on March 11 for a total of 58 students

and researchers. Attending were President Hiroshi Matsumoto, Executive Vice-President Akihiko Akamatsu, Executive Vice-President Kiyoshi Yoshikawa and other involved parties.

In his speech, President Matsumoto encouraged the students and researchers to play active roles on the global stage, as had John Mung, one of the first Japanese to study in the United States.



President Matsumoto Engages in Discussion with PM Abe at Japan-UK Universities Conference in London

May 1, 2014

Kyoto University President Hiroshi Matsumoto was an active participant in discussions on education and research at a conference of leading Japanese and UK universities, held at University College London. "Japan-UK Universities Conference for Collaboration in Research and

Education," a one-day meeting at UCL, brought together senior executives from 14 Japanese and 16 UK universities, who took part in a wide-ranging forum that examined successful joint programs, exchanges of students and researchers, and future challenges.

The bulk of the meetings comprised presentations from each university, highlighting important Japan-UK joint efforts. One oft-cited example was RENKEI, a program launched in 2013 by the British Council and 11 of the institutions participating in the conference. The program has already successfully realized two pilot exchange visits at Bristol and Kyoto.

President Matsumoto co-chaired a morning education panel discussion and succinctly summarized various issues for consideration, which he later presented to the Prime Minister. These included overcoming challenges such as credit transferability and curriculum compatibility.



Professor Yamagiwa Has Been Selected as the Next President

July 4, 2014

Professor Juichi Yamagiwa, Former Dean of the Graduate School of Science and the Faculty of Science of Kyoto University, has been selected as the university's next president. His selection was decided at a meeting of the President Selection Committee (Chairperson: Dr. Yuichiro Anzai, President of Japan Society for the Promotion of Science) on July 4, 2014. The President's six-year term begins on October 1, 2014.



Kyoto University Establishes Two New International Offices: The European Center in Heidelberg and the ASEAN Center in Bangkok



The Ribbon Cutting Ceremony at Heidelberg Office

Two new international offices have been established under Kyoto University's international strategy, "The 2x by 2020 Initiative," which was launched in June 2013 to develop and enhance the university's internationalization efforts. The Kyoto University European Center, Heidelberg Office was opened on the campus of Heidelberg University in Germany on May 3, and the Kyoto University ASEAN Center was opened in Bangkok, Thailand on June 28. The opening ceremonies for the two offices were attended by university officials and delegates from partner institutions, government bodies, and the private sector.

The primary functions of the Heidelberg Office are to support the university's research and education activities in Europe, promote the internationalization of faculty, staff, and students, and enhance the university's international public relations, industry-government-academia collaboration, and international networks. Kyoto University and Heidelberg University have maintained a strong partnership since the conclusion of an academic

cooperation agreement in 1990. In 2010, the two institutions became the co-chair universities of the German-Japanese HeKKSaGOn University Consortium, which comprises six leading research universities from Japan and Germany (Kyoto University, Osaka University, and Tohoku University from Japan, and Heidelberg University, Göttingen University, and Karlsruhe Institute of Technology from Germany). The Heidelberg Office will

also operate as a point of contact in Germany for the Japanese members of HeKKSaGOn.

Situated in central Bangkok, the Kyoto University ASEAN Center will serve as a regional hub to further develop the university's long-term commitment to diverse research and education engagements throughout the ASEAN region. The center will coordinate with the Bangkok Liaison Office of Kyoto University's Center for Southeast Asian Studies and other relevant institutions to strengthen the university's networks and partnerships with ASEAN universities, promote collaboration with industry and government, support the university's research activities in the region, and enhance the internationalization of students, faculty, and staff through internships and other programs.

Prior to the two new offices, Kyoto University's first overseas office was established in London in 2009 to facilitate the university's activities in Europe. Two more offices are scheduled to be established in the United States in 2015.



The Ribbon Cutting Ceremony at ASEAN Center

Heui-Soo Kim

Revealing secrets of human evolution through genetic research on human endogenous retrovirus

Heui-Soo Kim, professor of Biological Science at Pusan National University, received his doctoral degree at the Primate Research Institute of Kyoto University for his study involving molecular analysis of primate Y-chromosome genes. The best marker for evolutionary analysis is immanence on the Y-chromosome of hominoid primates (chimpanzees, gorillas, orangutans and gibbons), including humans. These studies became the foundation of Prof. Kim's future when he went to the Department of Molecular Neuropsychiatry in Warneford Hospital of Oxford University, United Kingdom, for postdoctorate research because he helped verify Prof. Timothy J. Crow's hypothesis that the "Origin gene of schizophrenia is located on the sex chromosome (X- and Y-chromosomes)". Endogenous retroviruses (ERV) inside the human genome are associated with schizophrenia induction; "ERV on the sex chromosome is the main cause" is Prof. Crow's idea. Professor Kim studies not just ERV, but various transposable elements as well, such as SINE (Alu), LINE, LTR (long terminal repeat). So let's take a look inside the Molecular Biology and Phylogeny Laboratory (MPL) in the Department of Biological Sciences at Pusan National University, led by professor Heui-Soo Kim, who received his doctorate degree from Kyoto University.

Excellent results on top of stored researches

MPL engages in diverse projects under the leadership of professor Heui-Soo Kim. Three representative projects they currently focusing on are:

First, research into the cause of disease, using genetic codes (sequences of the A, T, G and C characters).

Second, solving the mystery of human evolution, how humans have evolved.

Third, the retrovirus-- a problem in human organ transplantation, and how we might control it.

These research projects are related to recent graduate school students' scholarship awards. At the Principia of Genes and Genomics, Jeong-An Gim (master's course) received the 'outstanding thesis award' with a research paper revealing that transposable element (TE) regulates several genetic phenomena and influences the tumor gene and tumor repressor genes. At the Korean Association for Laboratory Animal Science, Yi-Deun Jung (doctor's course) received the 'outstanding poster award' for the 'NIH-Miniature Pig,' which is used among different species' organ transplant. At the Korea Genome Organization, Kung Ahn (doctor's course) received the 'grand prize for posters' on the function by which the TE inside the genome can act like miRNA in repressing primary biological functional genes. Professor Heui-Soo Kim said that through his students' awards, "only have to do" will let you gain confidence and accomplishment." From his students, who achieved recognition by immersing themselves in their research and working hard and quietly, he received great impetus for his own future studies.

Key to the mystery of Human Evolution

Professor Heui-Soo Kim's main subject, human endogenous retrovirus (HERV), is also drawing curiosity. As I stepped into his office, I saw miniatures of gorillas and monkeys which made me gain more curiosity. In the process of primate evolution, the virus that has gone into the human genome and influenced it in different ways has been identified. This is an endogenous retrovirus. It is associated directly and indirectly with unsolved diseases such as schizophrenia, cancer, proliferative arthritis, male infertility etc. Moreover, humans have evolved differently than gorillas and chimpanzees, and ERV may crucially influence human development. Professor Heui-Soo Kim said that "Many scientists did not know about the existence of ERV, and treated it as junk DNA. ERVs essentially function biologically, and since they comprise 45% of human genome, there are broad field to study." His love of retrovirus is endless.

Endless studies

MPL's research activities are unlimited given the never-ending study fields of the retrovirus. Ongoing researches are currently focusing on discovering or developing retrovirus-origin promoters and enhancers for application to gene therapy, examining how retroviruses are related to and induce unsolved diseases, and finding genome information to solve the mystery of human evolution. Thus

far, Professor Kim and his students have been at the center of these studies, but in future, they are planning on embarking a large project with world's known international professors and doctors.

Ember to flame

Retrovirus research is pioneering at MPL at Pusan National University. With stored bioinformatics research outcomes and excellent computer environments, they are deriving complex genome information that no one else in the world could. However, they have to study in an inadequate atmosphere, since this field is still not well respected. "With the base of studies on primate Y-chromosome genes at the Primate Research Institute of Kyoto University linked to University of Oxford in the UK, I have brought the studies on ember of retrovirus to Pusan National University. All three universities are now connected, continue to revealing parts of the puzzle of human evolution and engaging in studies of various diseases derived during the process of evolution. From now on we will become a greater factor in contributing to the realization of a disease-free and happier world for human life. We humbly request your interest and encouragement."



A story of circadian clocks on Earth

A clock ticks in the heart of the cell

FOREFRONTS OF RESEARCH AT KYOTO UNIVERSITY

Light/dark cycles are sensed as the passing of time

For most organisms, light/dark transitions caused by the rotation of the Earth are the most fundamental manifestations of the passing of time. Since the appearance of life, these transitions have been accompanied by changes in temperature, food availability and predator-prey relationship. Organisms have since learned to synchronize their activity to these changes by encoding time into their body in a biological mechanism called the circadian clock.

Time is encoded at the genetic level

The first organisms on Earth being unicellular, the circadian clock evolved into an intracellular mechanism composed of clock genes interlocked in transcription-translation feedback loops. Such a robust clock could be transmitted to the next generations. As a consequence of natural selection, most organisms now have clock genes. In multicellular organisms, this intracellular clock machinery is conserved inside each cell.

Multilayered rhythm generation and control

Rhythms arise at the level of genes, cells, tissues and organ systems. At system level, the suprachiasmatic nucleus in the brain (SCN) orchestrates rhythms in the whole body. The unique feature of circadian biology is that gene expression in the SCN determines behavioral and physiological rhythms perfectly, further supported by multilayered regulations strengthening the stability of the clock: transcriptional and posttranscriptional regulation (DNA methylation, histone modification, RNA methylation, protein modification including phosphorylation and acetylation,...). Moreover, intercellular communication via gap junctions and neurotransmitter/hormonal signaling coupled to G-protein-coupled receptors are now recognized as necessary for rhythm generation, and are themselves clock-controlled. In addition, critical cell events such as the cell cycle and cellular metabolism are also regulated by the circadian clock.

How Thomas Edison changed our lifestyle

The circadian system controlling our physiology is now threatened by our very own lifestyle. Among the many inventions of Thomas Alva Edison (1847-1931), electric light influenced our lifestyle like no other. For example, convenience stores routinely display bright lights mimicking day-time sunlight that excite the photorecipient cells in the retina, which then transmit signals through the optic nerve to the master clock in the SCN. This process induces clock gene expression and downstream cellular processes, leading to phase-shifts of the circadian clock controlling our activity rhythms, either causing insomnia or

Hitoshi Okamura

- Born in 1952
- M.D. & Ph.D., Kyoto Prefectural University of Medicine
- Professor, Graduate School of Pharmaceutical Sciences
- URL <http://www.pharm.kyoto-u.ac.jp/system-biology/e/>

Starting from the perspective that “the study of time is beneficial to society”

The objective of my study is always to contribute to disease treatment by elucidating what “time” is.

Professor Hitoshi Okamura began his career as a medical intern in neonatal medicine. Since changing his focus to neuroscience research, he has been investigating various structures in brain circuits that control complex functions. The biological clock is one of the brain function that governs circadian rhythms of body physiology including sleep and wakefulness. He was amazed by the fact that the paired oval suprachiasmatic nucleus (SCN), which is less than 1 mm in size, functions to generate internal time. Professor Okamura was convinced that he was born to reveal this secret.

Dissecting this nucleus from the brain, he successfully proved for the first time that the SCN keeps time, even *in vitro* on cover glass. He then identified a mammalian clock gene, and successfully elucidated the intracellular mechanism of circadian rhythm formation. He demonstrated that each of several thousand neurons of the nucleus produces a rhythm like a kaleidoscope. He also found that the biological clock exists not only in the brain but also in cells throughout the body. Based on his findings, he elucidated the mechanism of jet lag and has achieved many other research results concerning clock genes and biological rhythms.

Professor Okamura wishes that people recognize research into “time,” which has long been regarded as heterodoxy in medicine and biology. Society has become more aware of the risks posed by abnormalities in rhythm such as, for example, in increased shift work. On the basis of his experience as a doctor, he says, “My role is to approach research in terms of how I can contribute to the treatment and prevention of specific diseases.”



fatigue. Our circadian system is thus being challenged by this new artificial environment of our modern 24/7 society.

Our laboratory so far

Since the end of the last century, we have made important discoveries, including the identification of clock genes, the characterization of rhythms in a single cell, the regulation of the cell cycle by the clock, and the transduction of rhythmic signals via endocrine and sympathetic pathways throughout the body. We are currently attempting to further understand how the mammalian clock system works, and how it can be used to identify new fundamental mechanisms of gene expression regulation.

mRNA processing is required for accurate timing

We recently demonstrated that the clock is regulated at the level of RNA processing¹⁾. Methylation of internal adenosine residues (m⁶A) within mRNA was described in the 1970s, but its physiological significance remained unknown until now. We identified m⁶A methylation sites within several clock gene transcripts, thereby revealing RNA methylation as a potential new regulator of the circadian clock. Indeed, inhibiting m⁶A using pharmacological inhibitors and gene silencing of the m⁶A methylase *Mettl3* resulted in the elongation of the circadian period, while overexpression of *Mettl3* led to period shortening. These observations demonstrated the physiological relevance of m⁶A methylation.

Jet lag

Travelling rapidly across multiple time zones suddenly makes us aware of the consequences of a desynchrony between our internal clock and external time. Until now, the molecular mechanisms underlying jet lag syndrome were unknown. To identify candidate signaling molecules that might contribute to jet lag, we designed a screening strategy called SCN Gene Project, in which we sought to identify genes whose expression is enriched in the mouse SCN, generate mutant mice lacking these genes of interest, and submit these mutant mice to jet lag conditions and record their locomotor activity.

Genes encoding brain peptides and their receptors were the initial candidates because many of them are expressed in the SCN. We identified arginine vasopressin (AVP) and cognate receptors (V1a and V1b) as strong candidates²⁾, and found that circadian rhythms of behavior, body temperature and clock gene expression of mice lacking both

vasopressin receptors V1a and V1b (*V1a^{-/-}V1b^{-/-}*) rapidly re-entrained to a new light-dark cycle. Nevertheless, the behavior of *V1a^{-/-}V1b^{-/-}* mice was still coupled to the internal clock, which oscillated normally under standard conditions. Experiments with SCN slices in culture suggested that interneuronal communication mediated by V1a and V1b confers intrinsic resistance to external perturbation. Pharmacological blockade of V1a and V1b in the SCN of wild-type mice also resulted in accelerated recovery from jet lag, which highlights the potential of vasopressin signaling as a therapeutic target for management of jet lag and shift work.

Clock and diseases

Shift workers and those working long hours (>10 hours/day) can be considered to be in a “chronic jet lag” state. Epidemiological studies have demonstrated that shift workers have an increased likelihood to develop lifestyle related diseases, including metabolic syndrome, hypertension and cancer. To investigate the importance of the biologic clock for health, we used completely arrhythmic mice with the deletion of *Cry1* and *Cry2* clock genes (*Cry*-null mice), and found that these mice suffered from hypertension after high salt intake due to the severe overexpression in the adrenal gland of a new aldosterone synthesis enzyme *Hsd3b6*³⁾. Translational research led to the identification of the human homologue HSD3B1, expressed in aldosterone producing cells in the adrenal gland. We are now investigating the role of this enzyme in primary aldosteronism, an important human disease causing hypertension.

A clock ticks in the heart of the cell

Rhythm is a gift from our planet, and it is now known that a clock that synchronizes us with the Earth ticks at the core of the cell since the dawn of life. The forced change of lifestyles caused by the artificial light-dark environment will disrupt proper clock oscillations linked to fundamental cellular processes. Human diseases caused by clock disruption can thus be seen as originating from the destruction of natural environments. Circadian biology is a new journey of science that explores the secrets of how organisms have adapted to the environment for three billion years.

References

- 1) *Cell*, 155:793-806, 2013.
- 2) *Science*, 342: 85-90, 2013.
- 3) *Nature Medicine*, 16: 67-74, 2010.

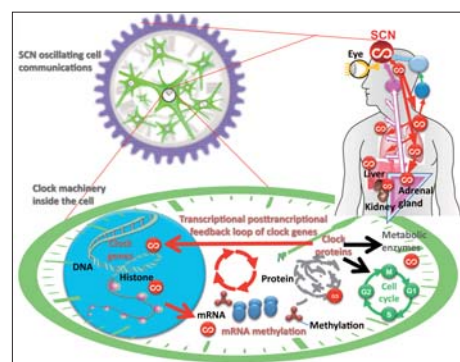


Fig.1 Circadian clock oscillation across many layers of life. At the cellular level, circadian clock is generated by a transcriptional-posttranscriptional feedback loop composed of clock genes regulating their own expression. Clock gene expression is also modulated by biochemical modifications of DNA, histones and proteins. This time keeping system regulates basic

metabolic processes at gene and enzymatic levels, and various steps of the cell cycle. At system level, the master clock located in the SCN synchronizes oscillation of clock genes at various organs. The synchronization of the circadian clock to the environmental light-dark cycles arises from direct retinal projections to the SCN. Recently, we added a new layer of posttranscriptional control of the clock by biochemical modifications, i.e., methylation of mRNA.

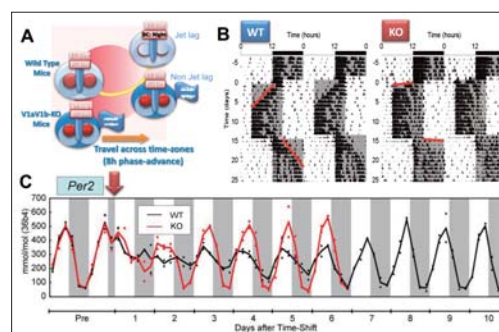


Fig.2 Molecular mechanism of jet lag. Schematic (A) and experimental (B) presentation of wild-type (WT) and V1aV1b double knockout (V1aV1b-KO) mice in 8-hour advanced jet lag. Dark background represents night-time and activity counts are shown as black

ticks (B). V1aV1b-KO mice immediately entrained to a new light-dark cycle, although WT mice takes about 9 days. (C) Rhythmic expression of circadian clock gene *Per2* in the SCN. Interestingly, initiation of jet lag (brown arrow) immediately stopped circadian oscillation of *Per2* mRNA, which gradually recovered by the 7th day (black line). On the contrary, V1aV1b-KO mice already recovered rhythmic on the third day (red line). This is the first identification of an animal not sensitive to jet lag. B, C are modified from *Science* 342: 85-90, 2013²⁾.

History of Recipes

FOREFRONTS OF RESEARCH AT KYOTO UNIVERSITY

My research theme concerns the modern history of food and agriculture in Germany and Japan, including their former colonies and territories. I selected these regions because I found many interesting examples there, concerning the connections between food and people. While these regions maintain a wide variety of traditional local dishes using special products of the respective locales, their agriculture and cooking cultures have undergone radical changes toward rationalization. In other words, an efficiency-oriented business approach has been adopted, which impersonalized and dehumanized cooking and farming practices. Historical studies of food are particularly interesting for me. I have also found them to be meaningful and worthy, since they are closely related to our daily lives.

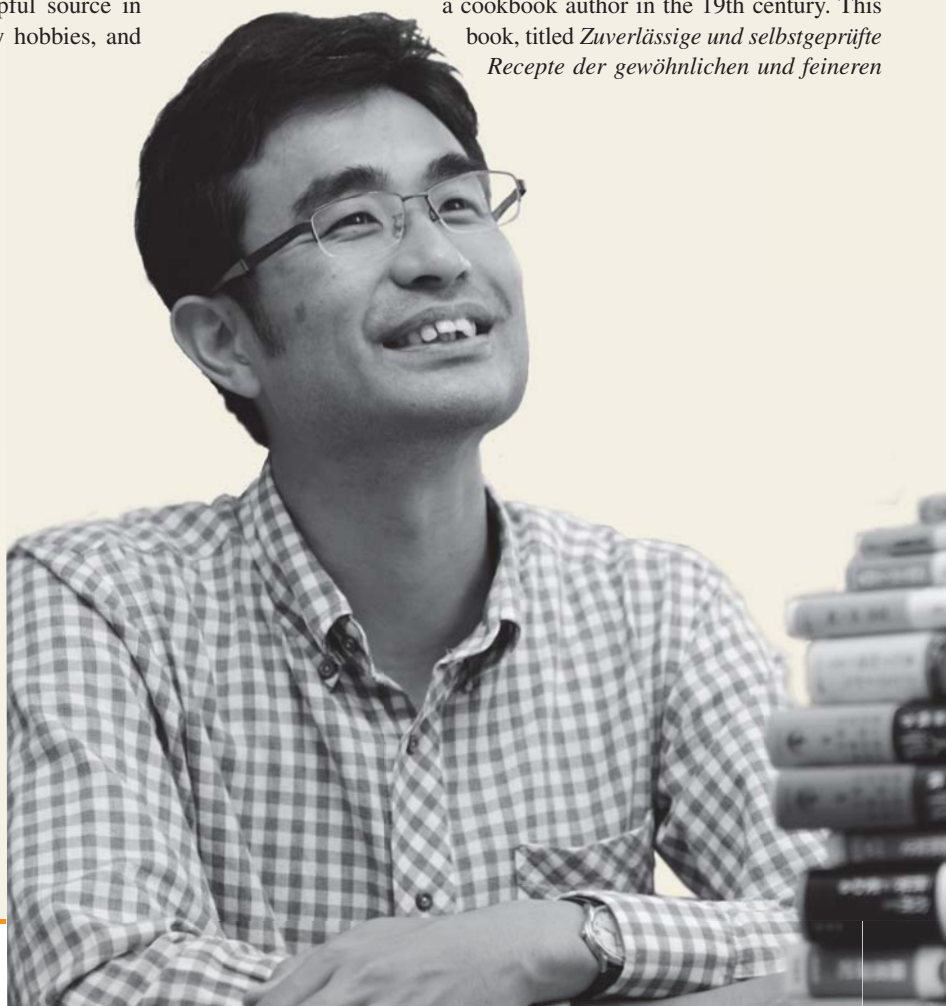
Studies of food history, however, involve a difficult problem: lack of historical materials. Daily meals were seldom documented, excepting those of royals and nobles, for whom menus were prepared. To study the history of meals of common German people from the 19th to the 20th century, I investigated diaries and memorandums written by people of the period, but found that most descriptions concerned special foods for festivals and events. Only a few documents describe daily meals of common people.

When I was utterly at a standstill, I found a helpful source in secondhand bookshops. Visiting them was one of my hobbies, and

indeed this helped me, since at such shops in Berlin and Leipzig I found a *Kochbuch* (cookbook) section. Subsequently, I found a wide variety of cookbooks, including the reprinted edition of recipes by Goethe's grandmother, a small recipe book prepared by a baking powder firm, a collection of recipes using electric cookers, a bestselling cookbook in East Germany, a book of easy and quick recipes for working mothers, and so forth. All had distinctive characteristics and traces of repeated use. In some, I found brief notes inserted between pages. Since recipes indicate the atmosphere of the respective epoch concerned, they hold high value as historical materials.

I also looked for recipes in libraries. At the Berlin State Library (*Staatsbibliothek zu Berlin*), I happened to find a book titled *Von Henriette Davidis bis Erna Horn. Bibliographie und Sammlungskatalog hauswirtschaftlicher Literatur. Mit Anmerkungen zur Frauenfrage* (From Henriette Davidis to Erna Horn: The Bibliography and Collection Catalogs of Books on Housework with Annotation Concerning Women's Issues) (2004). From among the 6,321 books listed in this bibliography, I selected those that had been reprinted in ten or more issues and the books that had sold at least 100,000 copies. After classifying such books into several categories, I analyzed trends of recipes. I also found a long bestseller by Henriette Davidis,

a cookbook author in the 19th century. This book, titled *Zuverlässige und selbstgeprüfte Recepte der gewöhnlichen und feineren*



Küche (Trustworthy Recipes Tested by Myself for Sophisticated Daily Dishes), was published repeatedly over a century by different editors. Cross-checking the first edition (1845), the sixth (1854), the 26th (1885), the 47th (1913) and the 57th (1960), I compared the numbers of recipes for specific dishes and their percentages in these editions.

The detailed results are indicated in my book *Nachisu no Kicchin – Taberu-koto no Kankyo-shi* (Kitchen in the Epoch of Nazis – History of Dietary Environment) (2012). To briefly explain, my conclusion includes the following three points: (1) Since the 1900s, fresh vegetable dishes, particularly salad, became popular in tandem with the soaring consumption of meat (vegetables came to be consumed without heating, so as to retain Vitamin C); (2) During the 1920s, books of healthy recipes, particularly those written by physicians at sanatoriums, began to sell more than those of traditional local dishes; (3) Over time, descriptions of precooking decreased in cookbooks, as did recipes for preserved food, such as bottled food, which was available at grocery stores. These facts indicate that cookbooks not only reflect the social trend of the respective epoch, but that they lead social changes.

In addition to quantitative analyses, I conducted qualitative analyses by analyzing discourses in the prefaces of cookbooks. In the first edition of the cookbook by Davidis, for

instance, the author writes: “Keep your kitchen clean, wash your hands and kitchen utensils, wipe the table, and wash vegetables thoroughly.” Target readers were workers of a factory located close to the author’s house. Although these instructions are common sense, the very fact that Davidis had to instruct her readers reflects the readers’ situation: having left their home villages, and being separated from their families, they had to rely on cookbooks to learn recipes and other issues necessary for performing domestic affairs.

Another bestseller, *Praktisches Kochbuch für die bürgerliche Küche. Mit 150 Abbildungen* (*Practical Recipes for Ordinary Citizens – With 150 Illustrations*) by Mary Hahn, was reprinted 285 times between 1913 and 1978. In its introduction, the author writes: “The way to your husband’s heart is through his stomach. This is an undisputed fact. Love alone cannot guarantee long-lasting happiness for couples. A bowl of too-salty soup or a burnt steak can sometimes lead to the collapse of a marriage.” Rather than merely introducing a stereotypical view of marriage, this comment indicates that meals have deep meaning and diverse aspects, in addition to the intake of nutrients.

Recipes reflect the social trends and atmospheres of the respective epochs, as well as the anxieties and aspirations of the people of those times. I will continue visiting secondhand bookshops in search of such classical recipes.



Tatsushi Fujihara

- Born in 1976
- Ph.D., Kyoto University
- Associate Professor, Institute for Research in Humanities
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Learning from history, particularly from past failures, I want to help build a better future

Associate Professor Tatsushi Fujihara developed a keen interest in agriculture and food. His parents had rice paddies, so he learned firsthand the various problems facing Japan’s agriculture, as well as the concerns and aspirations of Japanese farmers. These experiences inspired him to study agricultural history.

His equally deep interest in food is also related to personal experience. He recalls many happy memories associated with food: the rice balls he shared with team members of a sports club during his junior high school days, the fried eggs he cooked on an electric hot plate in a boarding house during his college days and the dishes he served his roommates when he was studying in Germany. Even the dark and old-fashioned kitchen in his parents’ farm house, where he found slimy

slugs, is now associated with happy childhood memories.

Historically, meals embodied deep meaning and fulfilled diverse functions, in addition to the intake of nutrients; partaking of food with other community members has long been an essential part of religious ceremonies. Meals also provided excellent opportunities for strengthening family ties and friendships. When Professor Fujihara considers contemporary dietary practices, however, he can only lament the fact that meals no longer fulfill many of their traditional roles. He attributes this change to excessive pursuit of efficiency in cooking and dietary habits. Driven by a strong sense of crisis toward the changing roles of meals, he began to study modern German kitchens, where he found the burgeoning concept of the unit kitchen. His research led him to discover many items in common between contemporary cooking culture and Nazi policies regarding domestic affairs.

Currently, he is focusing his attention on exploiting relationships between cities and farm villages. A great many workers once immigrated from less advanced to more advanced areas within their respective countries. Today, a similar flow of people is taking place on a global scale, transcending national borders. Movement of people from impoverished developing nations to thriving advanced countries leads to the collapse of rural cultures. However, “By describing traditional roles of meals and kitchens,” the Professor Fujihara says, “I want to revive traditional dietary practices, particularly collaboration in kitchens and the partaking of meals among community members.” He concluded, “Learning from history, particularly from past failures, I want to help build a better future.”



Prize, Award and Honor Winners

Professor Motomu Tanaka at the Institute for Integrated Cell-Material Sciences Won the Philipp Franz von Siebold Award 2014. (May 16, 2014)

The Philipp Franz von Siebold Award has been presented every year since 1979, directly from the President of the Federal Republic of Germany, to Japanese scientists who contributed to the promotion of mutual understanding between Japanese and German cultures and societies.



Humboldt Foundation/David Ausserhofer

Reason for Awarding

Professor Tanaka was awarded for his achievements in the research concerning the development of active bio matter physics, aimed at the understanding of life dynamics within the framework of physics of nonequilibrium systems, and for his efforts in academic exchange in interdisciplinary sciences between Japan and Germany.

Comments from Professor Tanaka

I am greatly honored to receive the Siebold Award, and hope to continue endeavoring for academic exchange between Japan and Germany, through interdisciplinary dynamic researches, revitalized development and the exchange of young researchers.

Kayo Inaba, Vice-President, Won the L'Oréal-UNESCO For Women in Science (March 4, 2014)

The L'Oréal-UNESCO For Women in Science is presented to excellent female scientists in the world who have made remarkable achievements in the field of life science.

Reason for Awarding

Vice-President Inaba elucidated the important role of dendritic cells in the immune system for protecting the human body against the threat of abnormal cells, such as invasive bacteria, viruses and cancer cells, demonstrating for the first time that immune reaction can be promoted by processing dendritic cells outside the human body, then returning the processed cells to the body.



Comments from Vice-President Inaba

I am greatly honored and very happy to win the L'Oréal-UNESCO For Women in Science, many of whose winners are female Nobel laureates. I am also deeply grateful to all researchers from Japan and from other countries, who have undertaken experiments together with me.

Professor Kazutoshi Mori at the Graduate School of Science Won the Shaw Prize in Life Science and Medicine (May 27, 2014)

The Shaw Prize was founded in 2002 by Mr. Shaw, a leading figure in the Hong Kong media industry. The prize has been awarded since 2004, this year marking the eleventh awarding. Professor Mori won the Prize in Life Science and Medicine together with Professor Peter Walter at the University of California, San Francisco.



Reason for Awarding

The discovery of the stress response of endoplasmic reticulum

Comments from Professor Mori

I am greatly pleased that the low-profile basic research I began since 25 years has been recognized. This award encourages me to make further efforts for the advancement of my research.

Tasuku Honjo, Guest Professor at the Graduate School of Medicine, Won the 2014 Tang Prize in Biopharmaceutical Science, in the First Awarding of the First International Taiwanese Prize (June 20, 2014)

The Tang Prize was founded in 2012 by Dr. Samuel Yin, a Taiwanese entrepreneur. The awarding was commenced in 2014. The Prize in Biopharmaceutical Science was won together with Professor James P. Allison of the University of Texas.



Reason for Awarding

Discoveries of CTLA-4 and PD-1 as immune inhibitory molecules that led to their applications in cancer immunotherapy.

Comments from Professor Honjo

I feel extremely humbled and honored by Tang Prize award. This is something I did not expect. However, I am more than happy by this recognition. First, our basic study about Pd1 and subsequent animal experiments carried out in Kyoto University are now shown to be applicable to cancer patients. Second, the international referees chosen by Academia Sinica appreciated our contribution. I hope the Japanese and other governments understand the importance of basic research whose social impact may not be visible, as is the case in Pd1 that took more than 20 years to be recognized. I also hope that the academia or university will receive a reasonable return from the industry to nurse the next generation who will create future seeds.

Itaru Imayoshi, Specified Associate Professor at the Hakubi Center / Institute for Virus Research, Won the 1st Prize for the German Innovation Award "Gottfried Wagener Prize." Hideki Hirori, Specified Center Associate Professor at the Institute for Integrated Cell-Material Sciences Won the 3rd Prize. (June 18, 2014)

The Gottfried Wagener Prize was founded by German companies that focuses on technological innovations, with the aim of promoting collaboration between industry and academia in Japan and Germany. The prize is awarded to excellent young researchers in Japan who have made innovative research achievements that will create a prosperous future.

Reason for Awarding

Itaru Imayoshi: Optical manipulation of neural stem cells in the adult brain

Hideki Hirori: Study on the generation of ultra-intense THz radiation sources and nonlinear spectroscopy

Comments from Winners

Itaru Imayoshi: At present, we are attempting to apply the optical manipulation of neural stem cells to animal models in relations to neurotrauma, neurodegeneration, mental disease etc. If the safety and efficacy of the technology we have developed are proven in animal models, it may become possible to apply this manipulation to the treatment of human nervous system diseases.

Hideki Hirori: Thanks to recent progress in laser technology, researches are rapidly advancing in the THz frequency band, which had been left unexplored. In this study, we succeeded in acquiring new findings concerning the carrier amplification process, which plays an important role in solar cells etc., through developing THz radiation sources of the world's most intense class. We believe that these findings will lead to the discovery of function control of chemical molecules and biomaterials.



Kyoto University accepts many international students who are interested in Japanese culture in Kyoto, Japan's ancient capital. Among such students is Ms. Scorus Oana Loredana from Romania. For seven years, she has been practicing *aikido*, a Japanese classical martial art for self defense. She has also been learning the art of the tea ceremony for six years. Currently, she is studying Japanese aesthetics at Kyoto University, from her original perspective.

When did you become interested in Japan?

I studied mathematics and information systems in high school, because I thought they were essential for contemporary society. However, I began to feel that I did not have an aptitude for these subjects. At the same time, I became interested in French language. So I enrolled in the Faculty of Foreign Languages and Literatures at the University of Bucharest.

Since Japan is an economic power, I thought that studying Japanese language would be helpful when I join the business world. So I decided to take Japanese language as my major, and French as my sub-major. Before deciding my major, I had already been interested in Japan to some extent. I once visited a website in Japanese language, where I saw a Chinese character, “置,” which evoked the image of a cat standing still. Subsequently, I read *Shogun*, a novel by James Clavell, which deepened my interest in Japan and Japanese culture.



We understand that you came to Japan for the first time in September 2008.

Yes, after completing the second grade, I enrolled in Nara University of Education, with which the University of Bucharest had concluded an international student exchange agreement. I studied in Nara until October 2009. I learned many new things and enjoyed having various new experiences. In Nara, the rhythm of daily life was slow, probably slower than in Kyoto, and I was able to appreciate Japanese traditional culture to my heart's content, in a relaxed atmosphere.

You maintained your interest in Japan even after you returned to Romania, didn't you?

Certainly. For my graduation thesis, I wrote about the structure of Japanese novels. I was deeply impressed by novels of Yasunari Kawabata and Yasushi Inoue, but impressions I gained from them were totally different from those of Western novels. With Japanese novels I had the impression that they had multiple plots arranged in parallel, and that each plot was described in a

matter-of-fact tone. I began studying this pattern, considering it to be characteristic to Japanese novels. In 2012 I enrolled in Kyoto University as a research student with a scholarship from the Ministry of Education, Culture, Sports, Science and Technology, Japan. In 2013, I entered the master's program, which I expect to be completed in 2015.

Will you tell us about your current research theme?

Well, it concerns the concept of “*ma*” (effective use of time and space intervals) in Japanese culture. A study of the structures of Japanese novels led me to discover unique functions of “*ma*.” At first glance, Japanese novels appear to comprise multiple sections arranged in uncoordinated fashion. This gives Western readers a dull impression. However, the presence of “*ma*” between respective sections enlivens the individual sections. In Japan, “*ma*” is used in diverse ways, and functions very well. For instance, you can recognize the effective use of “*ma*” in daily conversations and human relations. Currently, I am studying the “*ma*” in Japanese-style gardens, where rocks and plants are arranged in the perfect balance, so as to create an impression that the garden is larger than it actually is. In the landscaping of Japanese gardens, the “*ma*” or space between respective elements, such as rocks and plants, works to enhance the presence of each element, while at the same time creating an image of the boundless universe.

In addition to research activities, we heard that you are practicing Japanese traditional arts.

Yes, I practice the art of tea ceremony and aikido. I started learning both when I was a sophomore at the University of Bucharest (autumn of 2007). I practice tea ceremony art at the International Chado Institute (ICI), founded by the Urasenke School. To practice aikido, I joined a group known as Wakikai.



Ms. Loredana performing tea ceremony rituals

Finally, will you tell us your future plans?

I hope to visit other countries to introduce Japanese culture. In Japan, I learned the vital importance of *omoiyari* (consideration for others, compassion, empathy). I also enjoy Japanese performing arts, such as *Noh* and *kabuki* dramas. I believe that introducing Japanese culture will benefit people in other countries. Eventually, I hope to return to Romania and teach Japanese language, as well as other aspects of Japan that I am learning here.

INTERVIEW

“In the future, I want to promote overseas the aesthetic senses and values unique to Japanese people.”

Scorus Oana LOREDANA

Second year graduate student,
the Graduate School of Human and Environmental Studies





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For more than a millennium, Kyoto served as Japan's capital city, with its residents enjoying abundant natural blessings. Surrounded by mountains in three directions (north, east and west), Kyoto is fed by rainfall on the nearby mountains that gathers into the rivers, such as the Katsura, the Horikawa and the Kamo. In addition, a large underground lake lies deep beneath the basin. This lake is believed to be two-thirds the size of Lake Biwa, Japan's largest lake. The underground lake holds a reserve of abundant water that has been filtered through many ground

layers beneath the basin. The pure filtered water gushes up in various locales throughout Kyoto, some from deep wells. This crystal clear water has long supported the daily life of Kyoto residents, serving as a cradle of the City's culture, industries and businesses.

The pure water, which has little mineral content, has continued to support the development of Kyoto's traditional culture in various aspects. For instance, the water plays an essential role in Kyoto-style cuisine, the cornerstone of washoku or traditional Japanese cuisine, registered by UNESCO as an intangible cultural heritage. The essence of Kyoto-style cuisine is dashi or fish-and kelp-flavored stock, known for its delicate flavor and rich aroma, both of which are impossible to create without the pure fresh water from underground sources. Another example is Kyo Yuzen silk dyeing, for kimono that represents the elegance of the ancient capital. It once was a custom to wash dyed silk cloth in icy river water during the freezing winter, since the use of cold, clear water enhanced the brightness of the colors. Moreover, all three major schools of tea ceremony (Ura-Senke, Omote-Senke, and Mushakouji-Senke) are headquartered in Kyoto, since its water is ideal for extracting the flavor and fragrance of tea leaves. In Fushimi in southern Kyoto, breweries produce excellent *sake*, taking advantage of the soft water that slows the fermentation process of natural yeasts.

The tea ceremony, that flourished in Kyoto, led to the development of various other industries, such as Kiyomizu-ware ceramics and Japanese-style sweets. In

this way, the pure soft water has been supporting various time-honored cultural aspects over the past millennium.

京都 PROMENADE

Pure Water Flowing in the Kyoto Basin - Natural Blessings Help Foster Kyoto's Original Culture

① Otowa-no-taki cascade, a popular tourist spot in Kiyomizu Temple, is inscribed on the list of World Heritages. Many visitors to the temple purify their hands with the cascade water, which is believed to be efficacious for the health, longevity and safety of their families. ② Nashinoki Shrine, located on the east side of the Imperial Palace, is well known for its bush clover blossoms. In its precincts there is a well, known as Somei Spring, which is the only well intact among the three best wells in Kyoto. The spring water's sweet and mild flavor is ideal for making powdered green tea. ③ The soft water, having little mineral content, plays an essential role in the art of the tea ceremony, the art form completed during the 16th century by Sen no Rikyu. Head masters of respective tea ceremony schools have preserved and bequeathed wells in their respective residences to succeeding generations. The photo shows Daineiken Tea Ceremony House in Nanzenji Temple. ④ To wash away excessive dyes and starch from the fabric, dyed silk cloth was once washed in the Kamo River. Although scenes of colorful silk cloth swaying in the crystal water gave strong impressions to tourists, this process polluted the river water. To reproduce the scenes that were so popular among tourists, the washing process is still performed as an event of the annual summer festival. ⑤ *Sake* breweries stand here and there in the area between Keihan Railway Fushimi Momoyama Station and Chushojima Station. The best tourist spot in Fushimi is the area along the Horikawa Canal, with cherry and willow trees planted on both banks. Along the canal, visitors can find old *sake* brewery storehouses, restaurants run by brewers and museums of the *sake* industry.

